

**Strategy for Restoration and Protection of Scenic River Watersheds
Through Nutrient Management of Agricultural Activities**

By ODAFF 12/29/03

All of the agricultural related activities, except two nurseries, under the Oklahoma Department of Agriculture, Food, and Forestry's (ODAFF) jurisdiction, do not discharge directly to the Scenic River watersheds, which include the Upper Illinois River watershed with Upper Illinois River, Flint Creek and Barren Fork in stream segment 121700, Lee Creek and Little Lee Creek in segment 220200, and Upper Mountain Fork River in segment 410210. However, land application of poultry litter or other agricultural waste above the agronomic rates or applying on land already saturated with nutrients may become a non-point source contributing to the degradation of the water quality of the Scenic Rivers. The irrigation tailwater return flow from two plant nurseries in the Illinois River watershed could also contribute to the degradation of the water quality of the scenic rivers. Evaluation of the impact of these potential sources is necessary to establish a proper strategy to protect the scenic rivers and their watersheds.

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I- Evaluation of the Impact of Agricultural Sources Located in the Scenic River Watersheds:

- **Poultry Farms:** There are 115 poultry operations, more than half of them raising broilers, registered with ODAFF, consisting of 93 operations in the Upper Illinois River (UIR) watershed encompassing parts of Adair, Cherokee and Delaware Counties; 3 operations in the Lee Creek/Little Lee Creek (LLC) watershed encompassing parts of Adair and Sequoyah Counties; and 19 operations in the Upper Mountain Fork (UMF) watershed encompassing part of LeFlore and McCurtain Counties. These operations manage a total of 516 houses with 479 houses and 8,661,430 birds in UIR watershed, 8 houses and 140,800 birds in LLC watershed, and 29 houses and 346,900 birds in UMF watershed. Comparing to last year (2002) activities, the total number of poultry operations in the watersheds this year decreases about 8%; however, the number of houses increases 4.6 %, and number of birds increases 10% (from 8,309,510 to 9,149,130 birds). The general trend shows that the operations become larger; with more houses per each operation, and more birds in each house.
- **Amount of Litter Produced and Nutrient Generated by Poultry Farms:** More than half of the poultry operations in the watersheds raise broilers, and broilers normally generate more litter and nutrient than pullets, layers and turkeys. In the context of this report, the total amounts of litter and nutrients produced for all operations are estimated based on broiler's production rate of 18 lbs of litter per year per space, and its nutrient values of 46 lbs of total Nitrogen and 53 lbs of P₂O₅ per ton of litter⁽¹⁾. The estimated amounts of litter and nutrients generated in the different watersheds on an annual basis are summarized in the table 1 below. It indicates that the total amounts of litter as well of nutrients generated in the watersheds increase about 10% compared to

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those of last year. The increase is 11.5% in the UIR watershed, while they stay about the same in the LLC and UMF watersheds.

Table1: Amounts of Litter and Nutrient Generated in the Watersheds ⁽¹⁾

<u>Watersheds</u>	<u>Litter (ton)</u>	<u>Total N (ton)</u>	<u>P₂O₅ (ton)</u>	<u>Phosphorus P (ton)</u>
UIR	77,953	1,793	2,066	902
LLC	1,267	29	33	15
UMF	3,122	72	83	36
Total:	82,342	1,894	2,182	953

⁽¹⁾Table 11: Estimated Solid Manure Characteristics, Manure Characteristics, Manure Management System Series, Midwest Plan Service (MWPS)-18, Section 1.

The above estimation based on the actual bird space is more conservative than the traditional method of estimating based on a manure production rate of 125 tons per year per house. The total amount of manure produced per the latter method would be 64,500 tons (59,875 tons in UIR, 1000 tons in LLC and 3625 tons in UMF). Thus, the former method is more appropriate in the evaluation of the impact of poultry industries in the watersheds. It is also noted that the OSU (Oklahoma State University) Extension Facts F-2228 "*Fertilizer Nutrients in Animal Manure*" specified an average content of P₂O₅ of manure in Oklahoma of 61lbs per ton of manure for broiler. Based on this phosphorus content and the latter method for estimating manure produced of 64,500 tons, the total amount of P₂O₅ generated in the watersheds would be 1967.25 tons, compared to 2182 tons per the former method as presented in the above table. The difference between the two methods is within 10.0 % of each other.

The contents of Nitrogen (N) and Phosphorus (P) under the form of P₂O₅ in poultry litter are almost the same ratio: 1:1. However, litter is normally applied only onto the soil surface, and a considerable amount of nitrogen in the form of Ammonium (NH₄) will be converted to Ammonia (NH₃) and released to the air. Thus, the total N available for plant use is reduced. Meanwhile the demands of N for most crops are much higher than Phosphorus. To satisfy crop growth based on N need, litter would have to be applied at a higher rate, resulting in the build-up of unused Phosphorus in the soil. Run-off and erosion may carry the extra Phosphorus to the nearby streams. Several Scenic Rivers, especially the Illinois River, were affected by the presence of a high level of Phosphorus. Controlling Phosphorus will be very critical in the restoration and protection of these rivers.

- Soil Test Phosphorus (STP): ODAFF inspectors collected soil samples for STP at poultry operations located in several counties in or adjacent to the Scenic River watersheds in the Summer and Fall of 2002. The results indicated that more than 39% of samples collected exceeded the STP of 250, the threshold above which only half of normal phosphorus loading rate is

recommended to apply. Code 590 of the Natural Resources Conservation Service (NRCS) on Nutrient Management classified as Moderate rating for the soil with STP between 66 and 250, and recommended a full rate of waste application of 200 lbs of P_2O_5 , which is equivalent to 4 tons of litter, or less per acre of land with slope less than 8% and soil more than 20" deep. For High rating of soil with STP between 250 and 400, NRCS recommended half of the application rate for phosphorus.

The results of samples collected by ODAFF inspectors also indicated that more than 77% of the samples exceeded the STP of 120 and more than 33% of the samples exceeded the STP of 300.

- Impact Evaluation of Land Application of Poultry Litter on the Watersheds:**
 Since the above samples do not cover all lands located in the watersheds, that are either being used as land application sites or that may be available for future land application sites, the extra phosphorus loading, above and beyond the soil capacity for agronomic use, could not be accurately estimated. On the other hand, the limited data of STPs for lands currently being used for litter application in the watersheds, which have been submitted by Poultry Litter Applicators in their 2002 annual reports to the ODAFF office, showed a better picture with approximately 10% of the samples exceeding the STP of 250, 26% of samples exceeding STP 120, and 5% of samples exceeding STP 300. Based on a threshold of STP of 250 and the results of soil tests collected by ODAFF inspectors, we assumed that 39% of lands located in the watersheds that are being used for litter application are at capacity for P loading. Similarly, based on STP thresholds of 120 and 300, and ODAFF inspectors soil test results, the percentage of land at capacity for P loading corresponding to these thresholds would be 77% and 33% respectively. As a conservative measure for pollution prevention at the source, it is estimated that the amounts of extra poultry litter presented below, based on different STP thresholds of 120, 250 and 300, should either be transferred out of each watershed or be applied onto other available lands in the watersheds:

Table 2: Estimated Amount of Litter to be transferred out of Watersheds or Applied on Other Available Lands in the Watersheds Corresponding to Different STP Thresholds

<u>Watersheds</u>	<u>Extra Litter (STP 120)</u>	<u>Extra Litter (STP 250)</u>	<u>Extra Litter (STP 300)</u>
UIR	60,024 tons	30,402 tons	25,724 tons
LLC	976 tons	494 tons	418 tons
UMF	2,404 tons	1,218 tons	1,030 tons
Total	63,404 tons	32,114 tons	27,172 tons

The percentage of lands at capacity for P loading and the estimated amount of extra litter above will be revised once all STPs data are submitted to and verified by ODAFF and/or additional STP samples are collected by ODAFF

inspectors. These values will also be reevaluated based on the updated STP thresholds once revised or finalized by NRCS and/or OSU.

Depending on the terrain and slopes of the sites, the proximity to the Scenic Rivers and the nature and conditions of the intermediate zones between the sites and the waters, the impact could be significant or negligible. Therefore, to accurately estimate the impact of agricultural activities on water quality of Scenic Rivers, especially of the poultry operations in the watersheds, in-stream monitoring stations to measure nutrient levels up and downstream of the operations, and at the Oklahoma-Arkansas state line for monitoring of interstate phosphorus contributions should be established. Monitoring data will also help in reevaluating the effectiveness of pollution prevention measures applied in the watershed and the appropriateness of currently recommended STP threshold value. In monitoring nutrient levels at the edge of the operation fields or land application areas, site-specific STP threshold could be developed for each watershed and put in use for stricter control of Phosphorus loading in the watershed.

- **Status of Nursery Operations:** There are three (3) large containerized plant nurseries along the Illinois River that have had irrigation tailwater return flow enter the river. These operations were monitored monthly for nitrate-nitrogen, total-phosphorous and pesticides from 1989 to 2001. One operation became totally contained in 1998 and only has runoff leaving their property during large rainfall events. These nurseries signed voluntary compliance agreements with ODAFF to reduce their yearly average nitrate level in their discharge from a high of 27.99 mg/l NO₃-N in 1989 to 10 mg/l in 1996. They also agreed to reduce the Phosphorus (total) level down to 1 mg/l.

One existing large nursery with 120 acres in production was closed in 2003, and reopened under new management with only 20 acres in production. This has reduced the amount of irrigation tailwater entering the river, so as the amount of nutrient input to the watersheds. No new nursery operation came into existence along any of the scenic rivers in 2003.

II- Setting Goals for Reducing the Impact:

- Phase 1: 50% reduction of existing agricultural sources, to be achieved in 5 years.
- Phase 2: 100% of existing agricultural sources, to be achieved in 10 years.

Depending on resources available, the results of further soil sampling and the assessment of the level of impact contributed by agricultural sources on the watersheds, the above goals could be reevaluated in the future.

III- Strategy to Achieve the Goals:

(1) For Poultry operations:

- Evaluate the accuracy of STP data of lands located in the watersheds as submitted by poultry applicators through required annual reports to ODAFF; spot check the STPs, by conducting on site inspection and soil sample collection. Notify the applicators of the sites with currently more than an STP of 250 and do not allow them to apply additional litter on these lands.
- Coordinate with growers in locating available lands in the watersheds with STP less than 250 for future land application of litter. This will help determine the amount of litter, if any, to be transferred out of the basins/watersheds.
- Measure in-stream P levels upstream and downstream of the poultry operations and/or litter land application sites by setting up monitoring stations in the Scenic Rivers. Get access to currently available OWRB BUMP or USGS data on nutrient levels in the watersheds.
- Evaluate the above data to determine effectiveness of land application restrictions, and the appropriateness of the recommended STP threshold value.
- Select a typical litter land application site located within ¼ miles of a scenic river, coordinate with grower and/or NRCS to monitor phosphorus levels in the runoff water within 100 feet outside of the perimeter of the land application field after storm events, and to measure the phosphorus content of the soil of the field to determine the phosphorus amount leaving the field, if any, in order to develop or adjust the STP threshold specific for the watershed or sub-watershed.
- Continue to assist growers in developing nutrient management plans.
- Accelerate inspection and enforcement actions against violators of the Registered Poultry Feeding Operations Act and the permanent rules, and those who do not comply with requirements of Animal Waste/Nutrient Management Plans.
- Coordinate with intra and interstate agencies/entities in developing comprehensive nutrient management plans for the point and non-point sources located in the impaired watersheds.
- Continue to pursue cost-effective alternative methods of disposal of excess litter through ODAFF Market Development Division and Office of the Secretary of the Environment.

(2) For Nursery Operations:

- Conduct an inventory of fertilizer and pesticide operations in the scenic river watersheds.
- Monitor the irrigation return flow of the two remaining nurseries to maintain compliance with the voluntary compliance agreements and the new phosphorus standard.
- Monitor the river upstream and downstream from the nursery operations to determine if impact to the river is occurring.
- Assist operations with developing management plans to reduce nutrient loading.
- Involve pesticide manufacturers if pesticides are detected in any irrigation tailwater due to normal label use.
- Work toward total retention and recycling of the irrigation water with the use of state and federal assistance within 10 years.

IV- Tasks Performed by ODAFF:

(1) For Poultry Operations:

- Assisted growers in developing Animal Waste/Nutrient Management Plans. Currently more than 76% of poultry operations in the watersheds have submitted copies of these plans to ODAFF. An additional 25% of poultry operations have submitted the plans to ODAFF during this 2003 calendar year.
- Conducted inspections of all poultry operations located in the watersheds. 165 inspections were made in fiscal year 2003 (7/1/02-6/30/03).
- 205 technical assistances were provided in 2003 fiscal year to the poultry operations located in the watersheds.
- Enforcement actions against violators of poultry statutes and rules, which are located in the watersheds: In the 2003 calendar year 88 of the actions were taken in the form of warning letters. It was 15 % more actions taken this year compared to last year.
- Starting January 2004, ODAFF will cooperate with EPA in an outreach program to identify animal feeding operations qualified as CAFO for permitting under EPA's new CAFO rules. Approximately 10 poultry operations in the watersheds would fall into this category. Thus, they will better manage their waste; and would improve water quality of the watersheds.

(2) For Nursery Operations:

- Nursery operations were monitored monthly for nitrate-nitrogen, total-phosphorous and pesticides from 1989 to 2001. Results have been published in *The Curtis Report 1989-1992*, 1993, 1994, 1995, 1996, 1997
- Signed voluntary compliance agreements with nursery operations to reduce nutrient loading.
- Notified nurseries when they were out of compliance.
- Revised the nursery inspection form to reflect the status of runoff from rainfall and irrigation water; and to take samples if water is leaving the property.
- Completed 22 routine inspections during FY 2003 on the two operations located in the Illinois River watershed.
- Conducted 4 pesticides facility inspections on the operations in the Illinois River watersheds.